

CLAIMS

What is claimed is:

- 5 1. A method for selectively assembling a molecular device on a first substrate, comprising:
- (a) contacting the first substrate with a solution containing molecular device molecules;
- (b) impeding bonding of the molecular device molecules to the substrate sufficiently that application of a voltage potential to the substrate results in assembly of the molecular
- 10 device on the substrate at a rate that is at least 1.5 times the rate of assembly of the molecular device on a voltage-neutral substrate; and
- (c) applying a voltage potential to the first substrate so as to cause the molecular device molecules to assemble on the first substrate.
- 15 2. The method according to claim 1 wherein application of a voltage potential to the substrate results in assembly of the molecular device on the substrate at a rate that is at least 2 times the rate of assembly of the molecular device on a voltage-neutral substrate.
- 20 3. The method according to claim 1 wherein application of a voltage potential to the substrate results in assembly of the molecular device on the substrate at a rate that is at least 10 times the rate of assembly of the molecular device on a voltage-neutral substrate.
- 25 4. The method according to claim 1 wherein application of a voltage potential to the substrate results in assembly of the molecular device on the substrate at a rate that is at least 100 times the rate of assembly of the molecular device on a voltage-neutral substrate.
5. The method according to claim 1, further including:
- (d) providing a second substrate adjacent to the first substrate; and
- (e) contacting the first and second substrates with a solution containing second-type
- 30 molecular device molecules that are different from the molecular device molecules of

step (a) such that said second-type molecular device molecules assemble on said second substrate.

6. The method according to claim 5, further including electrically connecting the molecular device molecules assembled on the first substrate with the second-type molecular device molecules assembled on the second substrate with a conducting material.

7. The method according to claim 1 wherein the bonding of the molecular device to the substrate is impeded by providing a protective group on the molecular device molecule.

8. The method according to claim 1 wherein the molecular device comprises an oligo(phenylene ethynylene).

9. The method according to claim 1 wherein the molecular device comprises a thiol-terminated oligo(phenylene ethynylene) and the solution includes a base.

10. A method for assembling a molecular circuit on a first substrate, comprising:

- (a) providing a mixture comprising molecular device molecules in solution, each molecular device having a metal-bonding terminus protected by a protective group;
- (b) removing the protective group from a portion of the molecular device molecules;
- (c) activating the metal-bonding termini of the de-protected molecular device molecules;
- (d) contacting the first substrate with the solution; and
- (e) allowing the activated metal-bonding termini to bond to the substrate such that the molecular devices assemble on the first substrate.

11. The method according to claim 10 wherein step (c) comprises providing a base in the solution.

12. The method according to claim 10 wherein step (c) comprises providing an acid in the solution.

13. The method according to claim 10 wherein step (c) comprises applying a voltage to the substrate.

14. The method according to claim 10 wherein the molecular device is an oligo(phenylene ethynylene).

15. The method according to claim 10 wherein the protective group is selected from the group consisting of: thioethers, *S*-diphenylmethyl thioethers, substituted *S*-diphenylmethyl thioethers, and *S*-triphenylmethyl thioethers, substituted *S*-methyl derivatives, substituted *S*-ethyl derivatives, silyl thioethers, thioesters, thiocarbonate derivatives, thiocarbamate derivatives, and thioacetates/thiolacetates/thioacetyls.

16. The method according to claim 10 wherein the protective group comprises acetate.

17. The method according to claim 10, further including (f) attracting the activated molecular devices to the first substrate by applying a voltage potential to the substrate.

18. The method according to claim 17, further including repeating steps (a) – (f) with a second substrate and with second-type molecular devices that are different from the molecular devices assembled on the first substrate.

19. A method for assembling a molecular circuit on a metal substrate, comprising:

- (a) providing a mixture comprising molecular device molecules in solution, each molecular device molecule having a metal-bonding group;
- (b) contacting the metal substrate with the solution; and
- (c) applying a voltage potential to the substrate so as to attract the metal-bonding groups to bond to the substrate such that the molecular devices assemble on the substrate.

20. A molecular circuit prepared by:

- (a) contacting a first substrate with a solution containing molecular device molecules;
- (b) impeding bonding of the molecular device molecules to the substrate sufficiently that application of a voltage potential to the substrate results in assembly of the molecular device on the substrate at a rate that is at least 1.5 times the rate of assembly of the molecular device on a voltage-neutral substrate; and
- (c) applying a voltage potential to the first substrate so as to cause the molecular device molecules to assemble on the first substrate.

21. A molecular circuit prepared by:

- (a) contacting a first substrate with a solution containing molecular device molecules;
- (b) impeding bonding of the molecular device molecules to the substrate sufficiently that application of a voltage potential to the substrate results in assembly of the molecular device on the substrate at a rate that is at least 1.5 times the rate of assembly of the molecular device on a voltage-neutral substrate;
- (c) applying a voltage potential to the first substrate so as to cause the molecular device molecules to assemble on the first substrate;
- (d) providing a second substrate adjacent to the first substrate;
- (e) contacting the first and second substrates with a solution containing second-type molecular device molecules that are different from the molecular device molecules of step (a) such that said second-type molecular device molecules assemble on said second substrate; and
- (f) electrically connecting the molecular device molecules assembled on the first substrate to the second-type molecular device molecules assembled on the second substrate with a conducting material.